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Human Health Issue

At its first meeting (March 16, 1978) the Joint Policy and Program Council (JPPC) stated that investigation of effects of insecticides on human health was beyond the scope of the CANUSA Program. However, this subject is still of concern to resource managers faced with pest management decisions. At its 1979 meeting the JPPC concluded that (1) the role of the CANUSA Program should be to promote investigation in this area, and (2) more background information on the status of research is desirable. The Joint Planning Unit (JPU) was directed to investigate the status of research in both countries on the effects of budworm control materials on human health. As a result, a U.S. report and a Canadian report were prepared.

Both reports suggest that the agencies supporting the CANUSA Program should take an aggressive posture in evaluating potential control materials and formulation ingredients for (1) their fate and movement in forest ecosystems, (2) their residues in or on foliage, and (3) their impacts on nontarget organisms. Federal, State and provincial agencies responsible for control can provide the insecticide industry and regulatory agencies with information on the patterns and uses of control materials, and on the exposure of mixers, handlers and the public, resulting from suppression projects.

The U.S. report deals with the human health aspects associated with insecticides the CANUSA Program is interested in promoting for control of spruce budworm outbreaks or testing for possible registration. It includes information about EPA's registration guidelines so that comparisons between old and new registrations can be made. The U.S. report also includes information about the RPAR (Rebuttable Presumption Against Registration) "triggers," because these criteria basically list the critical issues that concern the regulatory agencies and the public about the possible dangers or adverse effects associated with the use of pesticides.

The report contains a discussion of the human health aspects of the following actives: trichlorfon (Dylox), acephate (Orthene), *Bacillus thuringiensis* (B.t.), carbaryl (Sevin). Sections on methomyl, aminocarb, and permethrin are in preparation. Other subjects included in the report are a brief summary of human health effects studies and concerns for selected insecticides, and a brief discussion of the types of research the Forest Service should conduct with regard to the human health aspects of the actives listed above.

The pesticide registration guidelines describe the kind of data which must be submitted to support registration. Newly proposed guidelines specify protocol, personnel requirements, test animal care and strain selection, and procedures for autopsy and histological examinations of test animals. Chronic feeding studies are proposed on

dogs as well as rats, and the chronic feeding study is lengthened from 2 to 3 years — just to list a few of the changes. Even though EPA is continually upgrading its registration guidelines, it tries to utilize old data in a common sense manner. If further data are needed to support a registration, EPA is empowered by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended, to request the additional data from the manufacturer as it recently did with 2,4-D. Therefore, pesticides registered under the old guidelines should not be viewed with any less favor than those most recently registered.

The RPAR "triggers" are important because they coincide with the critical issues or concerns raised by the public regarding the use of insecticides to control forest insects. A RPAR "trigger" will arise if results from laboratory or field tests on a pesticide's ingredient(s), metabolite(s), or degradation product(s) meet or exceed any of a set of criteria for risks dealing with 1) acute dermal toxicity of formulated or diluted product or inhalation of formulated product; 2) residues in food or water; 3) chronic toxicity, mutagenicity or other delayed toxic effects; 4) nontarget effects.

The summary of human health effects studies and concerns for selected insecticides refers to the Pesticide Incident Monitoring System Reports (PIMS Reports) which primarily cover incidents that involve some type of acute exposure to specific insecticides. The reports demonstrate the importance of a good monitoring system for both the mixers and applicators, and for environmental contamination.

The EPA is also conducting a comparative risk/benefit analysis of important pesticides used in forestry including carbaryl, acephate, trichlorfon, *Bacillus thuringiensis* (B.t.) and nucleopolyhedrosis virus. The "advisory document" resulting from this analysis can be used as a guide to consider the environmental impacts associated with the use of these insecticides in timber management. The risk assessments will be based on the results of a world-wide literature search and on toxicology data in EPA's tolerance petition file. April 1981 is the projected release date of the comparative document.

The Canadian report includes the results of a survey of Canadian research on health related issues, notes on the major areas of concern, some toxicological registration requirements, and the "triggers" for re-evaluation.

The survey of medical schools, universities and provincial health authorities in Canada conducting research on human health aspects of spruce budworm management revealed that only a few studies exist, and these are very specialized and subject to controversy. Suggestions to improve this situation include public education,

government testing, and joint U.S.-Canada registration of insecticides. A listing of toxicological requirements for Canadian registration and comments on temporary registration are included.

A re-evaluation is a review of the data package and literature on a registered product or active ingredient to determine whether or not registration should be continued. Re-evaluations are triggered by two factors:

- (1) Pest Control Products Section, National Health and Welfare Department, which is a new group that came into effect in December 1977. It is looking at all major use areas and is setting priorities on the bases of major deficiencies of the more toxic substances.
- (2) Public and political pressure which initiates many re-evaluations, and these rarely follow the priorities set by National Health and Welfare. This is of particular interest to forestry since it is frequently forestry pesticides which come under attack. National health and Welfare feels this criticism is unjustified because

the two major insecticides used in Canadian forests, aminocarb and fenitrothion, have very good toxicological packages and are being continually updated voluntarily by the companies involved.

The major deficiencies in older pesticide registration in Canada were that many of the longer term studies were not required. Prior to 1977 the Pest Control Products Section of National Health and Welfare did not exist, but National Health and Welfare would probably not have been concerned with forest products because food residues were not involved. This situation is being remedied by the re-evaluation process. Forest products, however, are generally considered to have good toxicological information.

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Figure 1. Attending the JPPC meeting in Victoria, B.C. left to right (front row) Bob Bourchier, Bob Buckman, John Ohman, Mel McKnight, Jack Sullivan, and Rudy Hanusiak; (second row) Fred Knight, Murray Neilson, Chuck Buckner, George Green, Jim Cayford, Gerald Anderson, and Bob Ethington.

Forthcoming Meetings

A two-day symposium of Insect Systems: Milestones and New Horizons in Endocrinology, Physiology, and Development will be held December 27-30, 1980, in the Seattle Center, Seattle, Washington. The seminar is in honor of Prof. Carroll M. Williams who for over 40 years has been a leader in insect endocrinology, physiology, and development. Information, forms for attendance, and a brochure with details of the meeting can be had from the American Society of Zoologists, Box 2739, California Lutheran College, Thousand Oaks, California 91360; or call (805) 492-3585.

Joint Policy and Program Council Meets in Victoria

The fourth meeting of the JPPC was convened August 19-20, 1980, in the Seminar Room of the Pacific Forest Research Centre, Victoria, B.C. Cochairmen Bob Bouchier and Bob Buckman introduced the new members and guests: John Ohman representing E. Roget, Washington, D.C., FS; Bob Ethington, Director of the Pacific Northwest Station; Dick Worthington, Oregon State Forester; Rudy Hanusiak, Deputy Minister, N.B. Natural Resources, replacing Jean-Noel Poulin as chairman of the Eastern Spruce Budworm Council; Don Owens and Mike Finnis, B.C. Forest Service; Gerald Anderson, FS, and Murray Neilson, CFS, Cochairmen of the Joint Planning Unit; Bill Sinclair, Executive Assistant to Assistant Deputy Minister, CFS; Jim Cayford, Director, Great Lakes Forest Research Centre; and special guest Les Reed, newly appointed Assistant Deputy Minister, CFS. Les helped in setting the theme of the meeting by emphasizing the importance of considering spruce budworms in forest management, and the need to achieve continuity in budworm research and protection. It is also important, he stated, to keep the general public and the various legislators fully informed of the benefits of the joint program. He assured the delegates that the spruce budworms problem has high priority in the CFS program.

Following a brief report on the recommendations of the Joint Planning Unit by the JPU Cochairmen, the Program Leaders reviewed the highlights of the program and the plans for the coming fiscal year. They emphasized the featuring of joint elements of the program and showed that the current revision of the Activity Schedule now contains well defined, expected program outputs. The JPPC endorsed the recommendation of the JPU to accept the revised Activity Schedule as the Master working document for the program, and recommended that the Chief, USDA-FS and the ADM-CFS approve the plan. The revised Activity Schedule will be distributed to the investigators with the next Newsletter.

Considerable discussion on the human health aspects of budworm control operations with vigorous input from Rudy Hanusiak, Fred Knight, George Green, John Ohman, and Jack Sullivan resulted in the resolve that the Program Leaders present a plan to foster research within the various agencies and institutions with mandates in the field, and to ensure that the CANUSA Program shows due sensitivity to these issues. Rudy



Figure 2. OK you guys, we know the slide is upside down.

Hanusiak and Murray Neilson, both from a highly sensitive area, indicated that from the resource management aspect, the human health issues held the highest priorities. The human health issue is one which the program has been wrestling with since its inception: on the one hand it is beyond the mandate of the CANUSA terms of reference; on the other hand, it continues to be one of the major resource management issues.

The JPPC noted the increased use of the Style Manual and Logo in reports and publications, and reiterated the resolve to ensure their use in all USDA-FS and CFS budworm-related manuscripts. It was encouraging to see the logo appearing on increasing numbers of reports emanating from the base program. Several examples were available for inspection. The Newsletter also received attention. The Council observed that the items and topics were pertinent, timely and of a comprehensive nature, and urged the Program Leaders to pursue this project with diligence. The Newsletter, it was pointed out, serves the function of broad program communication and also informs a wide audience of program developments.



Figure 3. *But if we suggest that, do you think they'll buy it?*

High priority was given to progress documentation, including scientific, technical, and display activities to publicizing program accomplishments. The group agreed in principle that the scientific achievements be disseminated at a "Budworm Congress" to be organized by the Program Leaders with assistance from the Program Managers. Transfer of technology to resource managers is to be achieved by timely workshops and technical bulletins as user information is produced.

In discussions on specific items, it was agreed that improvement of aerial application technology should be given increased emphasis. Several responsible agencies in both countries are currently addressing this problem, and the Council urged that these be approached with a view to accelerating programs in this field.

One afternoon was spent on research seminar format, with Roy Shepherd, Al Thomson, Dick Silversides, and Al Van Sickle providing sketches of their spruce budworm research. Clearly, there was considerable scientific and technical exchange with U.S. researchers, and the western components were obviously well integrated. The new CANUSA-West slide-tape show was also featured.

An informal dinner for the delegates and their wives was held at the Olde English Inn on Tuesday, August 19. Bill Young, Chief Forester for B.C., who had other commitments that precluded his participation in the sessions for the day, was present at the get-together, which provided an opportunity for additional information and planning interchange.

The next JPPC meeting is scheduled for August 25-26, 1981, in the Minneapolis-St. Paul area.

Newfoundland Royal Commission Holds Hearings

The Newfoundland Royal Commission on Forest Protection Policy is currently holding hearings on the management of budworm infested areas. Briefs by government departments, industry, private organizations, and the general public are being presented. John Hudak, Program Manager Protection for the Maritimes Forest Research Centre, is assembling the CFS brief with the coordinating assistance of Chuck Buckner. The final

document, some 300 pages in all, provides a comprehensive view of the budworm problem, its impact upon the forests and forest industry, its natural enemies, methods currently in use to manage infested areas, the ecological and human health implications of current management practices, and the prospects of developing alternative management tactics. Briefs are also expected from other federal departments and agencies: Canadian Wildlife Service, Inland Waters Directorate, Fisheries and Oceans, National Health and Welfare, and others. Hearings have been held in various locations in Newfoundland to provide residents an opportunity to express their views. Hearings are expected to continue until November with a final report to the Newfoundland Legislature by the year end.

Other Meetings

The 29th annual meeting of the Central International Forest Insect and Disease Conference (CIFIDC) was held September 29, 30 and October 1, 1980, at the University of Michigan's Camp Filibert Roth near Iron River, Michigan. The program featured current problems in the Lake States and adjacent Canada. Further information is available from John Witter, School of Natural Resources, S.T. Dana Building, University of Michigan, Ann Arbor, Michigan 48109; phone: (313) 764-1432.

Use of Exclusion Cages in Population Studies in the Western United States

Continuing studies on population dynamics of the western spruce budworm by Bob Campbell and Torgy Torgersen have concentrated on how the exclusion of predators affects the numbers of insects. In 1979, they designed and built bird exclosures for single branches, but the disappearance of budworms from the caged branches caused them to look for other, smaller predators.

Several papers now being prepared describe the season's results. Budworm survival to moth emergence was nearly two and one half times as high on branches protected by single-branch exclosures as on control branches in sites near Twisp, Washington. At 2 m (6 ft), survival on protected branches was five times as high as on control branches, but three times as high on protected branches at 5 m (16 ft). Other trials, where branches were stocked with pupae, showed that survival of pupae was six times as high on branches protected simultaneously by branch exclosures and a sticky barrier that excluded walking predaceous invertebrates, mainly ants. Major sources of mortality among larvae and pupae of the budworm in the sites studied appear to be avian insectivores and predaceous ants.

The study was expanded in 1980 to include new sites near McCall, Idaho. Curiosity about effects of predation on whole trees led to efforts to devise a durable, low-cost, easily erected exclosure of appropriate size. Design of the 9 m (30 ft) exclosure gradually evolved as a group effort by Campbell, Torgersen, Steve Forrest, and their

coworkers — with a vital contribution from Lloyd Forsman, the man in the hardware store who suggested they use PVC pipe for the framework. A prototype was built in November and, with the cooperation of Oregon State University's School of Forestry, it was installed around a tree on the grounds of neighboring Peavy Hall.

Construction of the 32 whole-tree exclosures used this summer began in February. A part-time crew, led by Forrest, put together 768 individual 2 by 3 m (6 by 9 ft) frames of the plastic pipe covered with plastic-mesh garden net attached to each frame by wire bag ties. (One measure of this undertaking is that 7 miles (11 km) of PVC pipe were ordered to build the exclosures.) The frames were trucked to the plots and assembled on the ground, first into 3-frame vertical planes, then in 4-panel half-exclosures, strengthened with 2 x 4's at every other corner.

Sixteen guy wires were attached to the supports while the exclosure was still on the ground. A folded, hinged, half-exclosure was pushed by the crew on the ground and pulled upright by someone in the bucket of a bucket truck, and then opened to form half an octagon about 2.5 m (8 ft) from the stem of the test tree. When the other half of the exclosure was in place, the guy wires were secured and the mesh lid stretched over the top.

One reviewer of the paper on construction of the exclosures questioned the authors' pre-1980 summer season estimate that two exclosures could be put up in a day. The crew in McCall managed to erect five in one day, and would have done six, but for a problem with an ailing ladder truck.

Results from this season's work in both areas — with both single-branch and whole-tree exclosures — are presently being analyzed, and the scientists are seeking explanations for the marked differences observed among the several plots and the variously treated trees. Preliminary results of studies with combinations of whole-tree exclosures and sticky barriers on the tree stems indicate that budworm populations on doubly protected trees may have survival rates more than ten times as high as on similar, unprotected trees.

The sturdy exclosures will be used again next summer on these same sites and in additional areas, perhaps Montana and New Mexico. Related activities include rearing of parasites, collecting life-table data, and observing influences of other insect populations.



Figure 4. Unfolding the second half-exclosure around a test tree.

B.t./Virus Field Tests in the West

Despite numerous problems, the field test of *Bacillus thuringiensis* is nearing completion. The project got off to an unfortunate start when the aircraft contractor, Rowd Sanders, was killed when a truck he was driving overturned. The time involved in getting another contractor followed by numerous mechanical and logistical problems, caused a serious delay in spraying. According to Milt Stelzer, project director, most larvae were in the fifth and sixth instar at the time of application. Popula-

tion densities were very high, averaging an estimated 180-200 larvae per 1000 in². Sampling was completed the week of July 21, but it is still too early to tell how effective B.t. was in reducing the population. Mechanical problems also beset the virus tests which ultimately had to be aborted.



Figure 5. Securing the guy wires on the completed enclosure.

Technology Transfer Working Group Formed

Membership of the Western Component Technology Transfer Working Group is almost complete. To date, the following people have accepted an invitation to participate in this key program activity:

Paul Buffam, Staff Director, FPM, Region 6, Portland, Oreg.
Louise Parker, Information Officer, PNW, Portland, Oreg.
Bill Ciesla, Director, Methods Application Group, FPM, WO, Davis, Calif.
Ladd Livingston, Idaho Department of Lands, Idaho
George Blake, Professor of Forest Genetics, University of Montana
Dave Baumgartner, Cooperative Extension Service, Washington State University
Pat Munro, Economist, Boise Cascade Corporation, Boise, Idaho
Bill Carter, Forester, FPM, Region 6, Portland, Oreg.
The first meeting was held November 18-20, 1980.

IPM Workshop: Decision Support System

CANUSA-West is developing plans to sponsor a workshop January 13-15, 1981, to acquaint potential users with the emerging decision support system for managing western spruce budworms. The workshop will involve users in the development of a computer based system to assess various budworm/stand management options. The decision support system will be designed to allow workshop participants to make use of all relevant information and to review any combination of management options selected. This will be a unique opportunity for users to influence the evolution of this system from its inception.

Western Fy 1980 Awards for RD&A Work

The following individuals have been approved for funding from CANUSA-West.

Study Title

Development of Models of Spruce Budworm Defoliation-Induced Changes in Tree Yield and Quality	Donald G. Burnell
Local Dispersal Mechanisms Describing Spruce Budworm Population Dynamics	Donald G. Burnell
Relating Foliage Nutrients of Two Hosts to Phenetic Characters	J.W. Brewer J.L. Capinera
Population Dynamics of the Western Spruce Budworm: Development of a Population Model	R.W. Stark R.W. Campbell
A Determination of the Resistance-Susceptibility Characteristics of Douglas-fir	Rex G. Cates

Use of Photo Interpretation and Remote Sensing Techniques to Establish Hazard Rating Criteria for Spruce Budworm Susceptible Forest Stands	Robert C. Heller
Growth Impacts on Host Trees Due to Spruce Budworm Defoliation	David R.M. Scott
Distribution, Sampling, and Mortality Factors of the Overwintering Stage	Thomas H. Egan
The Relationship of Western Spruce Budworm Outbreaks to Site/Stand Attributes, Development and Management History	K.J. Stoszek Peter Mika David St. Amand
Evaluation of X-Ray Energy Spectrometry Measuring Dispersal	John A. McLean
Socioeconomic Evaluation of Damage and Control	Thomas D. Bible J.D. Brodie

Publications Available

Pergamon Press recently published the proceedings of an International Conference on Pest Management. The volume includes papers by C.S. Holling, D.D. Jones, and W.C. Clark on "Ecological Policy Design: A Case Study of Forest and Pest Management"; D.D. Jones on "The Budworm Site Model"; and Christine A. Shoemaker on "Optimal Management of an Alfalfa Ecosystem." The CANUSA Program supports R&D related to the use of the Holling Model and Jerry Stedinger's modification of it for Maine conditions. Christine Shoemaker and Jerry Stedinger, both at Cornell University, are currently investigating modifications of the model directly applicable to Spruce Budworm Pest Management operations.

The Environmental Monitoring Group of the Forest Insect Control Operations Committee (EMOFICO) has assembled a report, edited by I.W. (Bill) Varty, on the environmental surveillance program carried out in New Brunswick during 1978-1979 in forest spray areas. Contact Bill at the Department of Forest Resources, University of New Brunswick, Fredericton, N.B. E3B 5P7.

An interesting pocket book entitled "Les principaux insectes défoliateurs des arbres du Québec" is available from the Entomology and Pathology Service, Ministry of Energy and Resources, Government of Quebec, 175 rue St-Jean, Quebec, P.Q. G1R 1N4.

Report 80-3 by Lawrence Stipe and John Hard, dealing with their trials using acephate and carbaryl for protecting Douglas-fir foliage and cones from budworm depredations, has been released by The Forest Insect and Disease Management Unit, USDA Forest Service, Northern Region, Missoula, Montana 59807.

Now available: Report 80-5 "Optimum Swath Widths and Application Rates for Selected Aircraft and Meteorological Regimes" by R.K. Dumbauld, C.R. Bowman, and J.E. Rafferty of the Methods Application Group, FIDM, USDA-FS, Davis, Ca 95616. Aircraft used were the TBM Avenger, Constellation, C-54, Bell 205, and Thrush. Meteorological conditions included very light, light, and moderate wind speeds in the late and early morning hours.

Other reports available:

1. J.B. Dimond and C.J. Spies, III. 1980. "A Comparison of B.t. Alone, with B.t. plus the additive Chitinase and Orthene[®] in Control of Eastern Spruce Budworms." Misc. Rpt. 224, Life Sci. and Agr. Exp. Sta., University of Maine at Orono. 15 pp.
2. G.A. Simmons. 1980. "Use of Light Trap Data to predict Outbreaks of the Spruce Budworm." Inf. Rpt. 80-6, Dept. Entomol. Michigan State Univ., E. Lansing. 13 pp.
3. S. Kleinschmidt, G. Baskerville, and D.S. Solomon. 1980. "Foliage Weight Distribution in the Upper Crown of Balsam Fir." Res. Paper. NE-455, Northeast Forest Experiment Station (NEFES), USDA-FS, Broomall, Pa. 8 pp.

State-of-the-Art Manuals

CANUSA-East Management in Broomall, Pa. has recently contracted for the production of two state-of-the-art manuals of interest to budworm workers. One of them, tentatively entitled, "State of the Art: Techniques for Monitoring the Environmental Impacts of Insecticides on Aquatic Ecosystems," should be available for distribution in 1981. The other, a field manual on common insect parasites of spruce budworms, will not be finished until 1982.